

1601/105

1602/105

**ELECTRICAL AND SOLAR  
INSTALLATION TECHNOLOGY**

**June/July 2023**

**Time: 3 hours**



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

**CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC TECHNOLOGY  
(POWER OPTION)  
(TELECOMMUNICATION OPTION)**

**MODULE I**

**ELECTRICAL AND SOLAR INSTALLATION TECHNOLOGY**

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Drawing instruments;*

*Non programmable scientific calculator/Mathematical tables.*

*This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.*

*Answer any **THREE** questions from Section **A** and any **TWO** question from section **B**.*

*All questions carry equal marks.*

*Maximum marks for each part of a question are as indicated.*

*Candidates should answer the questions in English.*

**This paper consists of 5 printed pages.**

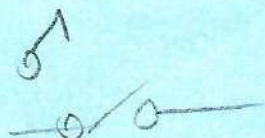
**Candidates should check the question paper to ascertain that  
all the pages are printed as indicated and that no questions are missing.**

## SECTION A: ELECTRICAL INSTALLATION

Answer any **THREE** questions from this section.

1. ✓ (a) With the aid of schematic circuit diagrams, describe the following classes of d.c machines:
- (i) Separately excited D.C generator;
  - (ii) Shunt motor.
- (8 marks)
- (b) Describe the constructional features of each of the following parts of a d.c machine:
- (i) Armature;
  - (ii) Commutator;
  - (iii) Brushes.
- (9 marks)
- (c) Outline **three** inspections checks carried out on a d.c motor. (3 marks)
2. ✓ (a) State **two** precautions observed when connecting each of the following to electrical power.
- (i) plugs;
  - (ii) edison screw type lamp holder.
- (4 marks)
- (b) Draw:
- (i) a lighting circuit with three lamps such that:
    - (I) lamp L1 is controlled by one-way switch S1.
    - (II) lamps L2 and L3 supplied from the same C.B and controlled by switches S2 and S3 independently.
  - (ii) **three** socket outlets connected in ring with a spur.
- (8 marks)
- (c) State **four** IEE regulations requirements in b(ii). (4 marks)
- (d) State **four** types of water heaters. (4 marks)

3. (a) Outline the functions of the following authorities in Kenya:
- (i) Rural Electrification Authority (REA);
  - (ii) Geothermal Development Company (GDC);
  - (iii) Energy and Petroleum Regulatory Authority (EPRA).
- (6 marks)
- (b) (i) State **three** advantages of A.C over D.C power supply system.
- (ii) Draw a labelled diagram of a three phase four wire system supplying both single phase and three phase loads.
- (10 marks)
- (c) Explain the functions of each of the following in a hydro-generating station.
- (i) Penstock;
  - (ii) Turbine;
  - (iii) Intake or control gates;
  - (iv) Generator.
- (4 marks)
4. (a) Define the following terms as used in protection of electrical installations:
- (i) Overload current;
  - (ii) Discrimination;
  - (iii) Fusing factor.
- (6 marks)
- (b) With reference to earthing, explain the following:
- (i) earth electrode;
  - (ii) earth lead.
- (4 marks)
- (c) With the aid of a labelled circuit diagram, describe the "earth fault loop path".
- (4 marks)
- (d) (i) State **three** disadvantages of fuses over circuit breakers in circuit protection.
- (ii) Draw a well labelled diagram of a rewirable fuse.
- (6 marks)



5. (a) State **two** properties of the following materials used in electrical cable:
- (i) copper;
  - (ii) brass;
  - (iii) rubber.
- (6 marks)
- (b) Outline **four** tests carried out in a completed electrical installation and in each case name the test instrument used. (8 marks)
- (c) (i) Draw a britania joint.
- (ii) Outline the procedure of making the joint in c(i). (6 marks)

### SECTION B: SOLAR INSTALLATION TECHNOLOGY

*Answer any TWO questions from this section.*

6. (a) Define the following terms:
- (i) solar constant;
  - (ii) solar irradiance;
  - (iii) photovoltaic (PV) device.
- (6 marks)
- (b) State **two**:
- (i) forms of energy conversion which are derived from the sun.
  - (ii) applications for each type of energy in b(i).
- (6 marks)
- (c) With the aid of a labelled diagram, distinguish between diffuse and direct solar radiation. (8 marks)
7. (a) (i) State **two** functions of a charge controller.
- (ii) Explain **two** methods of measuring the state of charge of a solar battery. (6 marks)

(b) Explain how the following factors affect the output of solar cell modules.

- (i) temperature;
- (ii) radiation intensity.

(4 marks)

(c) A 12 V d.c solar system supplies three 10W lamps and 60W television for 6 hours and 4 hours respectively in a day. Assuming no system losses, determine:

- (i) total daily energy demand;
- (ii) daily system charge requirement.

(4 marks)

(d) **Figure 1** shows an I-V curve, name and explain points A, B and C.

(6 marks)

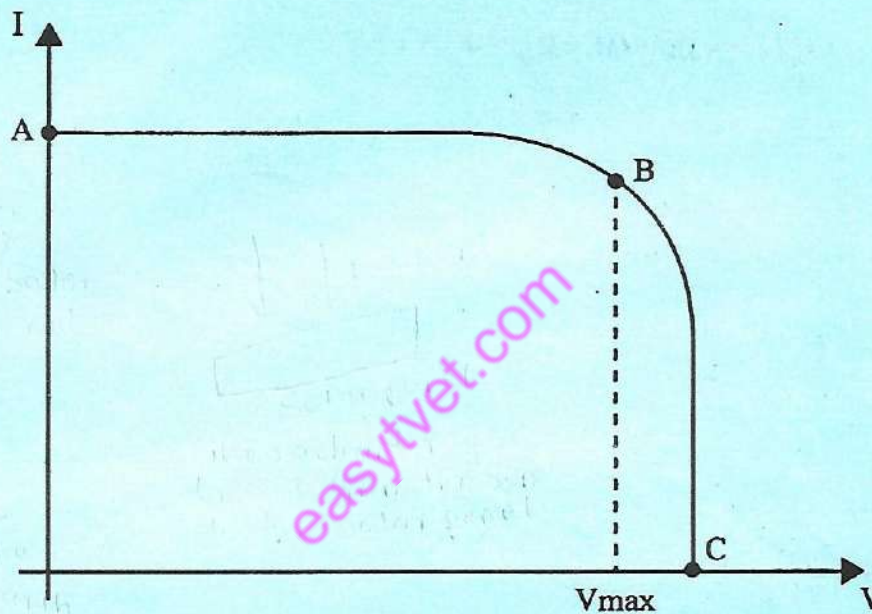


Fig. 1

8. (a) List **four** factors that are considered when choosing a solar wiring system. (4 marks)

(b) Differentiate between the low voltage disconnect and high voltage disconnect. (6 marks)

(c) Explain how concentrating type of solar cooker works stating two disadvantages. (6 marks)

(d) State **four** possible causes and remedies of a solar battery with a low state charge. (4 marks)

**THIS IS THE LAST PRINTED PAGE.**